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Canadian Science Advisory Secretariat
Newfoundland and Labrador Region | Science Advisory Report 2018/034

STOCK ASSESSMENT OF NEWFOUNDLAND AND LABRADOR ATLANTIC SALMON – 2017

Image: Atlantic Salmon (Salmo salar).

Figure 1: Map of the Newfoundland and Labrador Region showing Salmon Fishing Areas (SFAs) 1-14B.

Context:

There are 15 Atlantic Salmon (Salmo salar) management areas, known as Salmon Fishing Areas (SFAs); 1-14B, in Newfoundland and Labrador (NL) (Figure 1). Within these areas there are 394 rivers known to contain wild Atlantic Salmon populations that are characterized by differences in life history traits, including freshwater residence time, timing of return migration, age at first spawning, and the extent of ocean migration.

Conservation egg requirements for Atlantic Salmon were previously established for individual rivers in Labrador (SFAs 1-2) based on 1.9 eggs per m^2 of river rearing habitat, the Straits Area of Labrador (SFAs 14A-14B) based on 2.4 eggs per m^2 of river rearing habitat and 105 eggs per hectare of lake habitat, and Newfoundland (SFAs 3-13) based on 2.4 eggs per m^2 of river rearing habitat and 368 eggs per hectare of lake habitat. Conservation egg requirements were considered to be equivalent to a Limit Reference Point (LRP).

The Fishery Decision-Making Framework Incorporating the Precautionary Approach (Fisheries and Oceans Canada [DFO] 2009) identifies two reference points for managing fisheries stocks, the LRP and Upper Stock Reference Point (USR). As per the Precautionary Approach Framework, Atlantic Salmon stock status is now assessed based on the proportion of the river-specific LRP and USR achieved. The LRP corresponds to the previously defined conservation egg requirement and the USR is defined as 150% of the previously defined conservation egg requirement. Status is also described in terms of trends in returns, smolt production and marine survival rates.

Annual comparisons are generally made to the previous five-year mean for Newfoundland and six-year mean for Labrador, which correspond to the average Atlantic Salmon generation time in those areas.

This Science Advisory Report is from the February 28-March 1, 2018 Regional Peer Review Process on the Assessment of Atlantic Salmon in NL. Additional publications from this meeting will be posted on the DFO Science Advisory Schedule as they become available.

July 2018

Canada

SUMMARY

- Nineteen populations of Atlantic Salmon were assessed in 2017. Adult salmon were counted on four rivers in Labrador and fifteen rivers in Newfoundland. Five of the fifteen assessed rivers in Newfoundland also counted juvenile salmon (smolt) migrating to sea.
- In 2017, fifteen monitored rivers showed declines in total returns, and twelve of these fifteen rivers had declines of greater than 30% compared to their previous five-year mean. For four rivers, data were unavailable to compare 2017 returns to the previous five-year mean.
- Two consecutive years of declines of this magnitude over a wide geographic range are highly unusual for the NL Region since the commercial moratorium (1992).
- In 2017, river status on the basis of returns is similar to that based on spawners.
- In 2017, spawning escapements (eggs) were below the river-specific Limit Reference Point (LRP) on three of the four assessed rivers in Labrador; however, spawning escapement of the fourth river exceeded its Upper Stock Reference Point (USR).
- In Newfoundland, spawning escapements (eggs) were below the LRP for nine of the fifteen (60%) assessed rivers. Of the remaining Newfoundland rivers assessed in 2017, five out of fifteen (33%) rivers exceeded the USR and one assessed river fell within the cautious zone (between the LRP and USR).
- Marine survival continues to be the major factor limiting the abundance of Atlantic Salmon within the region. Returns in any given year are determined primarily by marine survival rather than variations in smolt production. Inter-annual variation in marine survival continues to fluctuate, with survival in 2017 ranging between 3.7% and 7.7% for the three monitored rivers where marine survival estimates were available.
- Estimated Labrador Aboriginal and subsistence fisheries harvest was inferred from logbook returns (56% return rate) at 13,600 salmon in 2017 (7,200 small, 6,400 large), which was 4% less than the previous six-year mean (2011-16) of 14,100 salmon (9,000 small, 5,100 large).
- Genetic analysis of Atlantic Salmon in Labrador fisheries (2006-16) indicated that the majority of salmon were of Labrador origin (95-99%).
- Estimates of recreational catches for NL have been highly variable since 2005 (total catch range of 38,900 to 76,100 salmon). Preliminary estimates of retained and released salmon in 2017 were approximately 19,400 and 22,800, respectively.
- Status of Atlantic Salmon on the south coast of Newfoundland (SFAs 9-11) remains poor. Returns to Conne River in 2017 were only 710 fish, the lowest on record over the 32-year time series, and were equivalent to only 32% of the LRP. Marine survival rates remain low at less than 4% in most recent years. There is evidence of hybridization between wild and farmed salmon juveniles throughout Fortune Bay and Bay d'Espoir and the long-term consequences of this on wild salmon populations are uncertain.
- A regional Composite Climate Index of various measures of meteorological, sea ice, ocean temperature and salinity conditions shows a warming trend since the mid-1990s that peaked in 2010, but thereafter decreased to mostly below normal conditions during the past four years. Such broad-scale ocean climate conditions are associated with primary and secondary production indices in the northwest Atlantic region. The large reduction in zooplankton biomass observed since 2015 indicates lower potential energy transfer to higher trophic levels including Atlantic Salmon.

- Sea ice departure in the inshore regions along the east and northeast coast of Newfoundland in 2017 was delayed by up to 45 days in some areas resulting in a significant delay (up to 50 days) in the spring warming (to 3°C) of inshore coastal waters.
- The consequences of these environmental conditions on total returns of salmon in 2017, survival rates of smolts migrating in 2017 and adults returning in 2018 are unknown.
- There were large unexpected declines in 2016 and 2017 in Atlantic Salmon returns. Expected returns in 2018 cannot be accurately predicted. Based on the experience of 2017, an in-season evaluation of returns to date with projections for the end-of-year abundance accurately predicted the returns for 2017. A similar approach could be considered for 2018.

BACKGROUND

Species Biology

Juvenile Atlantic Salmon remain in freshwater habitats for two to five years in Newfoundland and three to seven years in Labrador (Figure 2) prior to undergoing smoltification and migrating to sea as smolts. Spawning populations in Newfoundland and Labrador (NL) consist of varying proportions of small (fork length < 63 cm) and large (fork length ≥ 63 cm) adult salmon (Figure 3). For the majority of rivers in Newfoundland (SFAs 3-12 and 14A), small adult spawning salmon are predominantly grilse (one-sea-winter, 1SW salmon) that have spent one year at sea before returning to spawn for the first time. The large salmon component in these Salmon Fishing Areas (SFAs) consists mainly of repeat-spawning grilse which are spawning as either a consecutive or alternate spawning fish. In contrast, Labrador (SFAs 1, 2 and 14B) and southwestern Newfoundland (SFA 13) populations are comprised of important large salmon components that contain maiden fish that have spent two (two-sea-winter, 2SW) or more years (multi-sea-winter, MSW) at sea before spawning. For most monitored rivers, small salmon are predominantly female (range of 60-92% across rivers). The adult spawning migration generally begins from late-May to mid-June for most rivers in Newfoundland and late-June to early-July for monitored rivers in Labrador. Run timing for returning salmon is influenced by climate conditions on the NL Shelf, occurring earlier in warmer years and later in years with colder water temperatures and high amounts of inshore sea ice.

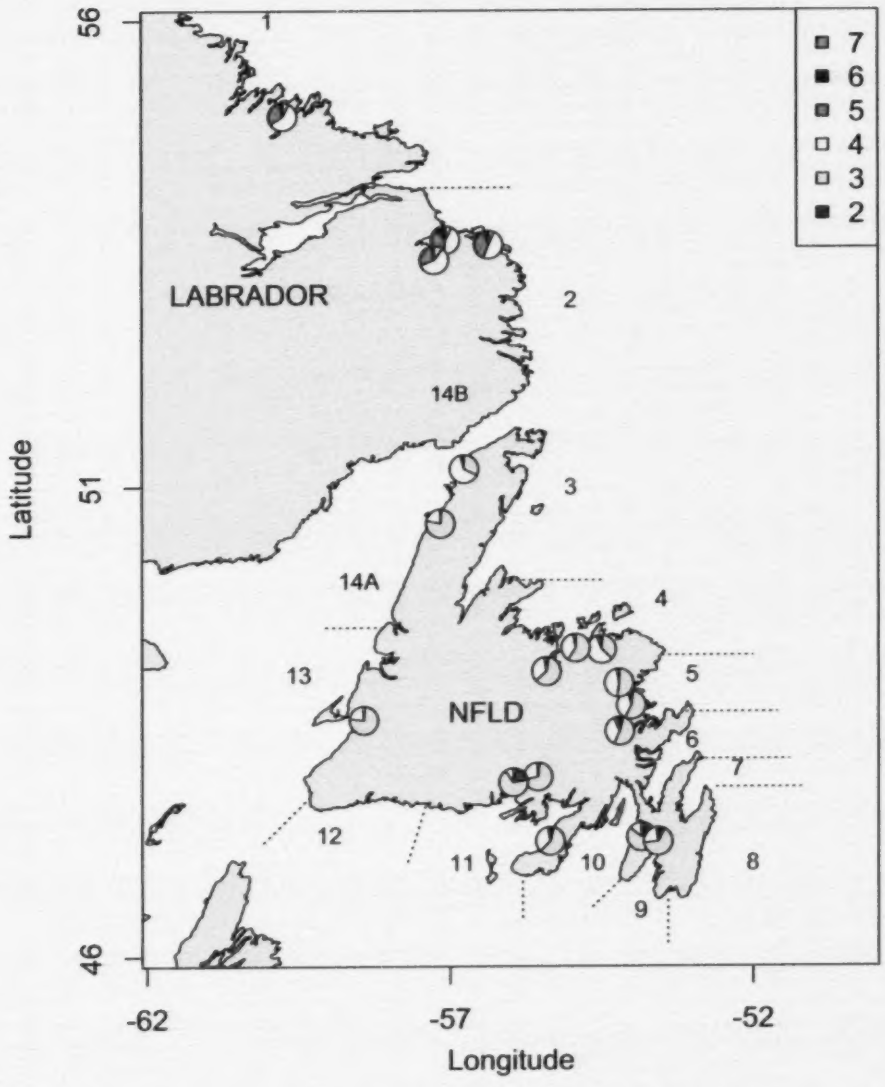

Figure 2: Smolt age distribution for eighteen rivers assessed in Newfoundland and Labrador in 2017. Average smolt age proportions were calculated for each river using smolt scale age data over the entire time series and only included years where sufficient sample sizes were available. Smolt age data were unavailable for Corner Brook Stream; therefore, this river is not represented. The boundary of each SFA is indicated by dotted lines.

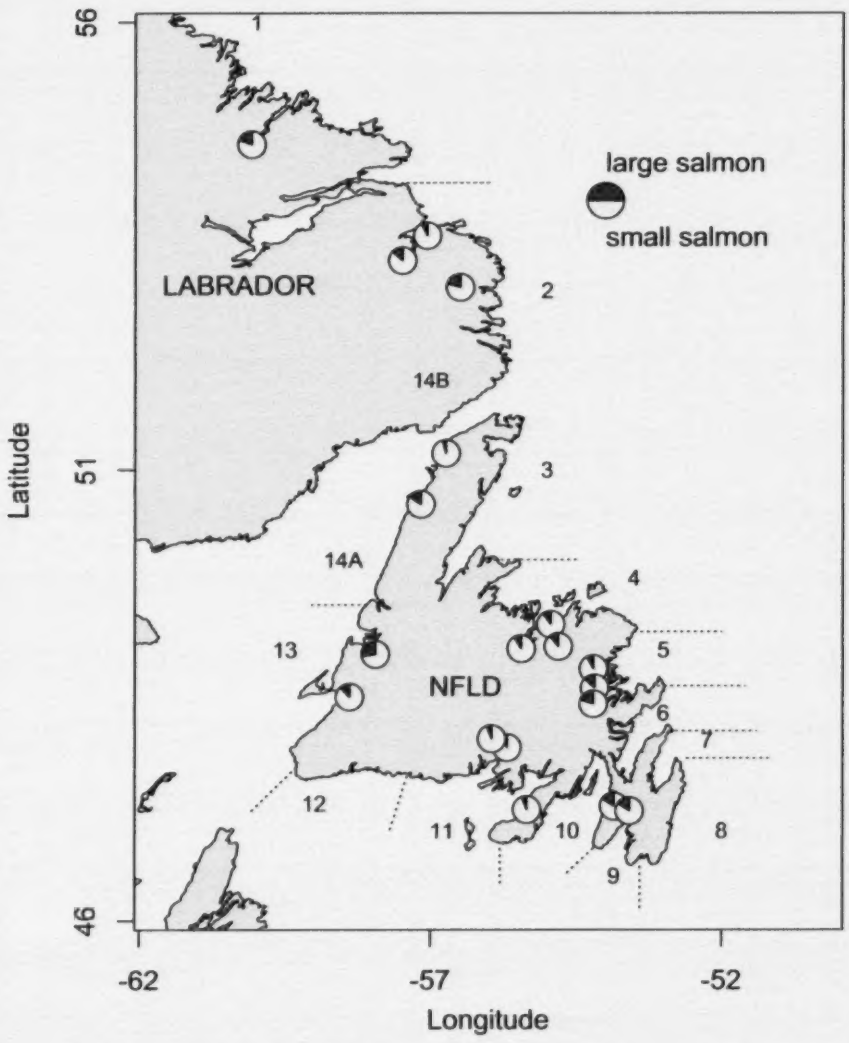

Figure 3: Proportion of small (fork length <63 cm) and large (fork length ≥63 cm) Atlantic Salmon across nineteen rivers assessed in 2017. The boundary of each SFA is indicated by dotted lines.

Recreational Fisheries

The recreational Atlantic Salmon fishery is managed according to a River Classification System, which is used to establish retention levels based on the health of individual salmon populations without jeopardizing conservation goals. A five-year Integrated Atlantic Salmon Fisheries Management Plan was introduced for NL in 2014 which was used to guide management decisions for 2017.

In 2017, the recreational salmon fishery for all Labrador rivers opened June 15 and closed September 15. Retention of large salmon has not been permitted in Labrador since 2011.

In SFA 1 and some SFA 2 unclassified scheduled rivers, anglers could retain four small salmon for the season (Class 4); other scheduled salmon rivers in SFA 2 and all SFA 14B had a two fish retention (Class 2). The lower retention limit in these rivers was implemented to address expected increases in fishing pressure following construction of the Trans-Labrador Highway (TLH). Recreational catch data were derived from outfitting camp logbooks for SFA 1, a combination of logbook and individual angler logs (Licence Stub Return data) for SFA 2, and Licence Stub Return data for SFA 14B.

The 2017 recreational salmon fishery for all Newfoundland rivers opened on June 1 and closed on September 7. A fall catch-and-release angling fishery occurred on Class 6 (season retention limit of 6 small salmon) rivers from September 8 to October 7 (retention permitted on main stem of Gander River from August 1 to October 7). Retention of large salmon in Newfoundland has not been permitted since 1984.

The 2017 recreational catch statistics for Newfoundland were derived from Licence Stub Return data. These data are considered preliminary and will be updated following a phone survey in March 2018 of anglers who did not return their logs (non-respondents). Recreational catch and effort data may also be adjusted if sufficient new information (e.g. receipt of additional vendor licences) is received by DFO. Recreational catch for the NL Region from 1994 to 2017 is presented in Figure 4 and Table 1. Estimates of recreational catches for NL have been highly variable since 2005 (total catch - retained and released; range of 38,900 to 76,100 salmon). Preliminary estimates of retained and released salmon in 2017 were approximately 19,400 and 22,800 fish, respectively. These data indicate a 27% and 22% decline for retained and released salmon, respectively as compared to the previous five-year mean (2012-16). On August 6, all salmon rivers in Newfoundland were restricted to catch-and-release only due to significant declines in salmon returns. Anglers in NL are largely retention-oriented (Veinott and Cochrane 2015), so when retention angling ceased this may have contributed to the observed decline in estimated total catch and harvest for the 2017 season.

Environmental Conditions – Freshwater Environment

In the event of extreme environmental conditions during the recreational angling season (e.g. low water levels, high water temperatures), there is a process in place for closing rivers which involves field observations by fisheries guardians, regular measurements of water temperature and expected changes in weather. These data sources are compiled and provided to DFO Resource Management to make the final decision on river closures. The water temperature threshold is typically set at 22°C; however, when the recreational fishery switched to catch-and-release only (no retention) in August 2017, this threshold was reduced to 18°C. During the 2017 angling season, 88 out of 158 (56%) scheduled rivers in Newfoundland were closed for part of the angling season due to environmental conditions. Closures generally occurred in late-July and early-August and affected all zones except SFAs 12, 13 and 14A on the south and west coasts of the island, consistent with previous years (Dempson et al. 2001). No rivers were closed in Labrador. In total, 19.9% of angler days were lost due to environmental closures in Newfoundland in 2017, the highest since 1987 (36.9%).

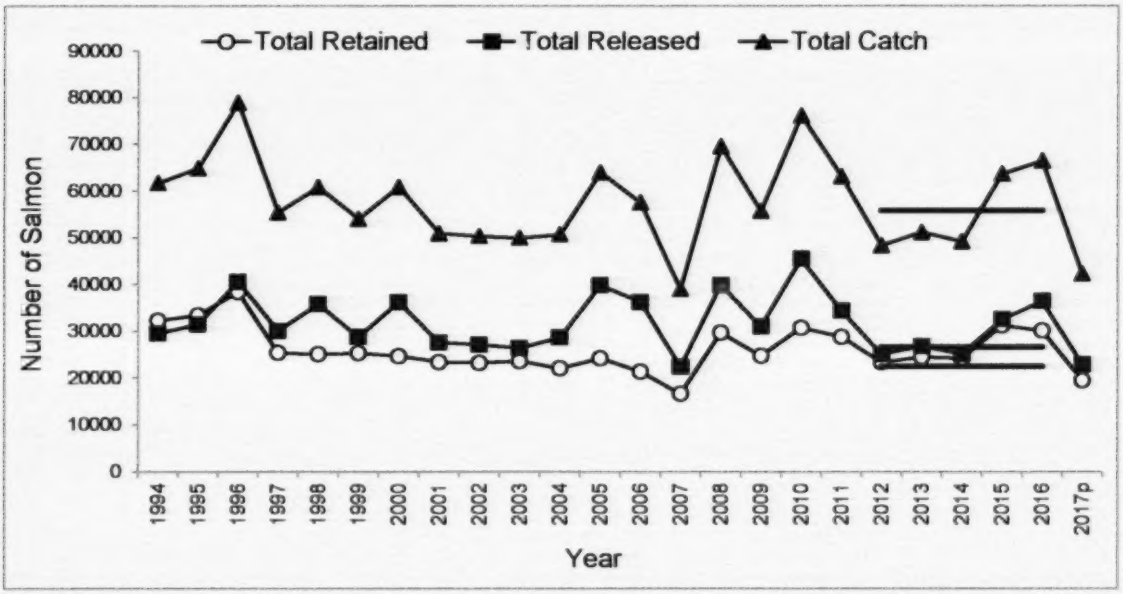

Figure 4: Recreational catch of Atlantic Salmon, size groups combined, for the NL Region (1994-2017): total retained (open circles), total released (black squares) and total catch (black triangles). Horizontal solid lines represent the previous five-year mean (2012-16). Recreational catch and harvest estimates for 2017 are preliminary (2017p). Catches (number of retained and released) for small and large salmon and effort are summarized in Table 1.

Aboriginal/Subsistence Fisheries

There has been no commercial salmon fishing in Newfoundland (SFAs 3-14A) since 1992, in the Straits area of Labrador (SFA 14B) since 1997, and in the rest of Labrador (SFAs 1-2) since 1998.

In Newfoundland, Miawpukek First Nation holds a Food, Social and Ceremonial (FSC) communal salmon fishing licence, but has chosen not to harvest salmon under this licence since 1997 due to conservation concerns.

Aboriginal FSC fisheries for Atlantic Salmon, Arctic Charr and Brook Trout occur in Labrador under communal licences. Labrador also has a Subsistence Fishery, known as the Labrador Resident fishery, for trout and charr with a permitted retention of salmon by-catch (three salmon since 2011).

Labrador FSC and subsistence fisheries harvests were inferred from logbook returns (56% return rate), and were estimated at 13,600 salmon in 2017 (7,200 small, 6,400 large), which was 4% less than the previous six-year mean (2011-16) of 14,100 salmon (9,000 small, 5,100 large) (Figure 5, Table 2). Large salmon represented 36% of the catch by number. Harvest estimates for 2017 are preliminary.

Region of origin of salmon harvested in the Labrador FSC and subsistence fisheries from 2006 to 2014 has indicated that upwards of 97% of the salmon originate from Labrador (Bradbury et al. 2015; ICES 2015). Based on samples taken from the coastal Labrador fishery from 2015 (n=549) and 2016 (n=268), mixture estimates suggest the harvest is dominated by a single region, central Labrador (98-99%). Recently, additional work has produced a range wide single nucleotide polymorphism baseline for Atlantic Salmon (96 loci) and a microsatellite baseline for finer scale geographic assignment in Labrador. The preliminary results using this approach provide identical results to those reported previously.

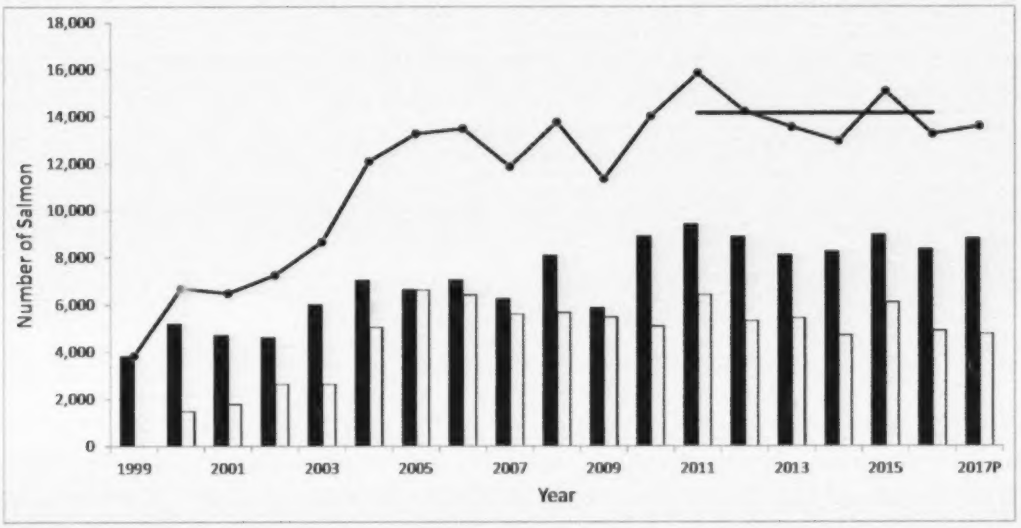

Figure 5: Numbers of estimated Atlantic Salmon harvested in Labrador Aboriginal and subsistence fisheries in SFA 1 (black bars), SFA 2 (white bars) and total harvest (black circles) from 1999 to 2017. Horizontal solid line represents the previous six-year mean of total harvest (2011-16). Harvest estimates for 2017 are preliminary.

Other marine mixed stock fisheries that harvest Atlantic Salmon of Newfoundland and Labrador origin

The reported harvest of Atlantic Salmon in the St. Pierre et Miquelon fishery has ranged from 0.8 t to 5.3 t during 1991 to 2016. Based on genetic analyses of samples from 2004 to 2015, the majority (>70%) of salmon in this fishery originated from three main regions of eastern Canada: Gulf of St. Lawrence (38%), Gaspe Peninsula (32%), and Newfoundland (24%) (Bradbury et al. 2016b; ICES 2015). In 2016, a total of 146 samples from the fishery were analyzed, and estimates of stock composition showed consistent dominance of salmon from the same three regions: Gulf of St. Lawrence, Gaspe Peninsula, and Newfoundland.

The mixed stock Atlantic Salmon fishery at West Greenland harvests Atlantic Salmon originating from eastern North America and the northeast Atlantic, consisting primarily of 1SW non-maturing salmon (i.e., fish destined to return to rivers primarily as 2SW maiden salmon). Reported harvests at West Greenland have ranged from 9 t to 58 t during 1998 to 2016, equivalent to 2,300 to 12,800 salmon of North American origin (ICES 2015). Region of origin analyses, using the genetic baseline described above, indicated that Labrador origin salmon comprised approximately 20% of the total salmon originating from eastern North America with Newfoundland origin salmon representing a smaller proportion at <4% (Bradbury et al. 2016b; ICES 2015).

ASSESSMENT

Beginning in 2017, the status of Atlantic Salmon populations is assessed relative to two reference points, defined on the basis of egg depositions, as per the Fishery Decision-Making Framework Incorporating the Precautionary Approach. The Limit Reference Point (LRP) is set at 100% of the previously defined conservation egg deposition rate. Populations below the LRP would fall in the critical zone, so management actions should promote stock growth and fisheries-related mortality should be kept to the lowest level possible. The Upper Stock Reference point (USR) is set at 150% of the previously defined conservation egg deposition rate. Populations above the USR are considered to be in the healthy zone and are therefore available for exploitation at some predetermined maximum exploitation rate. Populations with a status between the LRP and USR fall within the cautious zone, so management actions should promote stock rebuilding to the healthy zone.

In 2017, nineteen populations of Atlantic Salmon were assessed in NL (Figure 6). Returning adult salmon were counted on four rivers in Labrador and fifteen rivers in Newfoundland, while smolts were counted on five of the assessed rivers in Newfoundland (Figure 6).

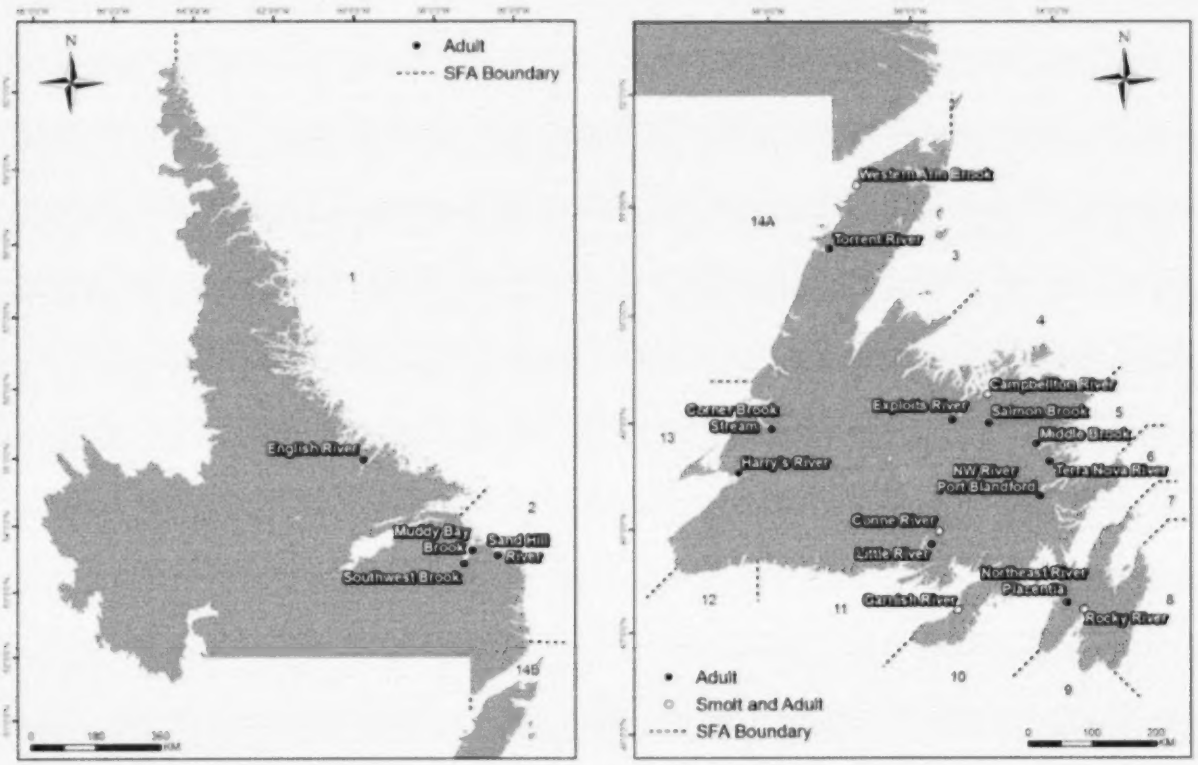

Figure 6: Maps showing the locations of rivers in SFAs 1–14B where Atlantic Salmon populations were monitored in 2017. Adult salmon were counted at all facilities. Five facilities counted or estimated salmon smolts (white circles). The boundary of each SFA is indicated by dotted lines.

Resource Status – Adult Salmon

Newfoundland and Labrador (SFAs 1 to14B)

In 2017, estimated Atlantic Salmon egg depositions, whether by returns or by spawners, exceeded the USR on one of the four assessed rivers in Labrador (English River) and five of the fifteen assessed rivers in Newfoundland (Campbellton River, Middle Brook, Northeast River (Placentia Bay), Torrent River and Western Arm Brook) (Table 3). Estimated egg deposition for one river in Newfoundland (Corner Brook Stream) fell within the cautious zone (i.e. between the USR and LRP). For three of the four assessed rivers in Labrador and nine of fifteen assessed rivers in Newfoundland, estimated egg depositions were below the LRP and the populations were assessed to be in the critical zone (Table 3). Overall, out of fifteen monitored rivers with recent long-term monitoring records, twelve (80%) recorded declines in total returns of greater than 30% and fourteen (93%) recorded declines in conservation egg requirement achieved in 2017 compared to the previous generational mean (five and six years for Newfoundland and Labrador, respectively). The returns in 2017 for five of these rivers (Conne River, Little River, Campbellton River, Southwest Brook and Salmon Brook) were the lowest on record. Observed declines in 2016 and 2017 of this magnitude over a wide geographic range are highly unusual for the NL Region.

Northern Labrador and Lake Melville (SFA 1)

There are nine scheduled salmon rivers in SFA 1. One river was assessed in 2017: English River, near Postville. It is worth noting that a count was attempted on a second river, Kenamu River in Lake Melville, which was unsuccessful due to unfavourable environmental conditions (e.g., extremely high water levels).

Total returns of salmon on English River in 2017 were 3% lower than the previous six-year mean, despite a 41% increase in large salmon returns (Figure 7, Table 3).

Estimated egg deposition based on total returns of salmon to English River in 2017 was greater than the values of the previous six years (Table 3) and exceeded the USR. English River has exceeded the LRP value in the last seven years.

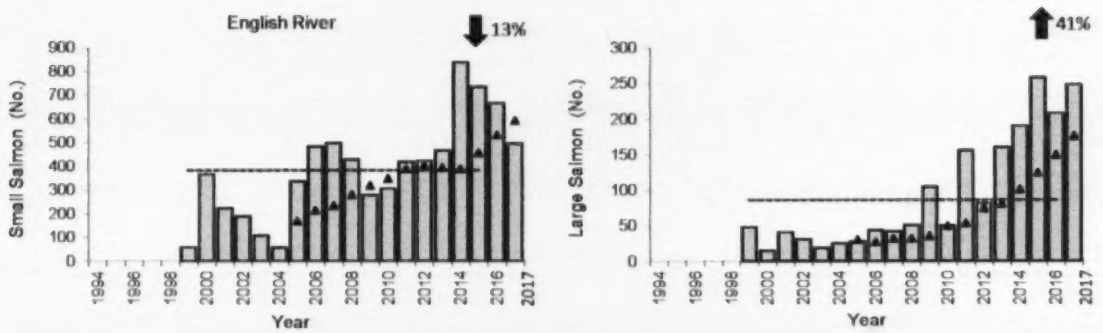

Figure 7: Total returns of small and large salmon in the single monitored river of SFA 1, English River, 1999 to 2017. The dashed line is the average of the post-moratorium time series (1998-2016). The black triangles are the previous generation average (six years) for each year.

Southern Labrador (SFA 2)

There are sixteen scheduled salmon rivers in SFA 2. Three rivers were assessed in 2017: Sand Hill River, Muddy Bay Brook (Dykes River) and Southwest Brook (tributary of Paradise River).

In 2017, total returns of small and large salmon were lower than the previous six-year mean (2011-16) on all three of the monitored rivers (Figure 8, Table 3) with Southwest Brook setting a record low.

Estimated eggs based on total returns of salmon in 2017 were lower than the previous six-year means (2011-16) and below the LRP on all three assessed rivers (Sand Hill River 52%; Muddy Bay Brook 83%; Southwest Brook 22%; Table 3). However, it should be noted that no data were collected in 2012 for Muddy Bay Brook. For Sand Hill River, retention fisheries for small salmon and assumed mortalities resulting from catch-and-release fisheries for small and large salmon reduced egg deposition by an estimated 3% (Table 3).

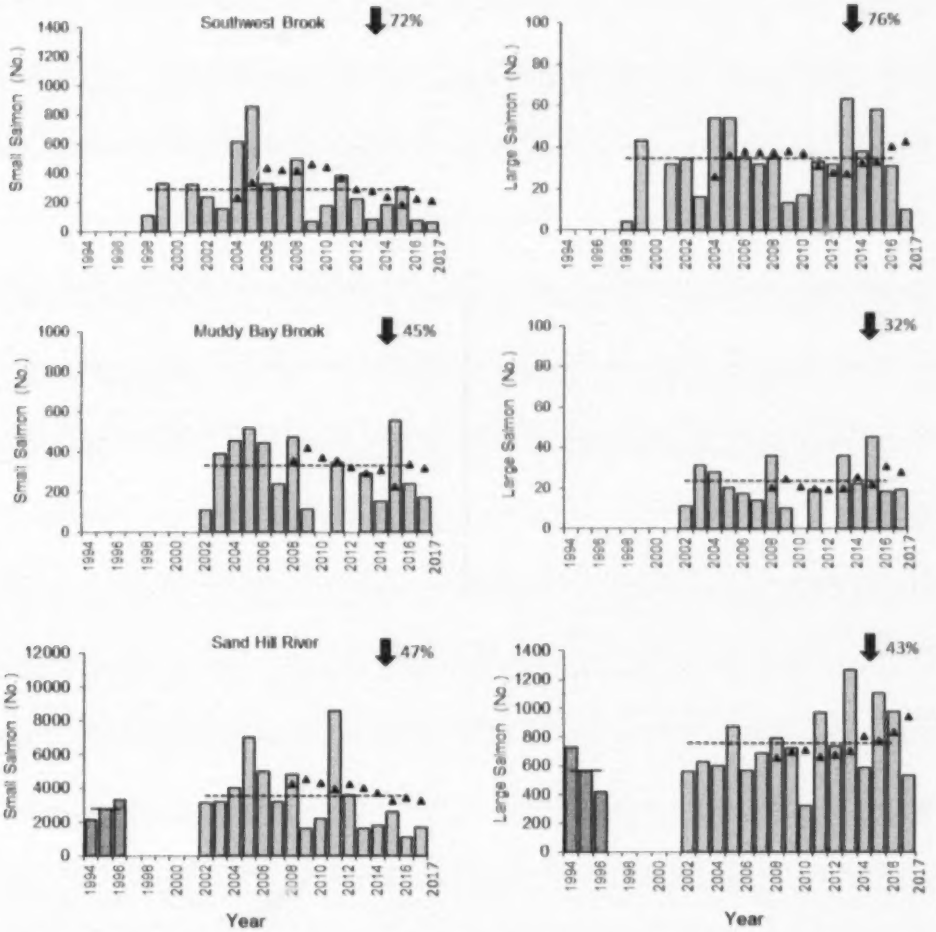

Figure 8: Total returns of small and large salmon at the monitored rivers in SFA 2, 1994 to 2017. The solid black line is the average of the pre-moratorium time series (1994-96) and the dashed line is the average of the post-moratorium time series (1998-2016). The black triangles are the previous generation average (six years) for each year.

Labrador Straits (SFA 14B)

There are three scheduled salmon rivers in SFA 14B. No rivers were assessed in 2017.

Northeast and Eastern Newfoundland (SFAs 3-8)

There are 60 scheduled salmon rivers in SFAs 3-8. Six rivers were assessed in 2017: Exploits River, Campbellton River, and Salmon Brook (tributary of Gander River) in SFA 4, and Middle Brook, Terra Nova River and Northwest River (Port Blandford) in SFA 5. No rivers in SFAs 3, 6, 7 and 8 were assessed in 2017.

Compared to their previous five-year means (2012-16), total returns of small and large salmon in 2017 declined on Exploits River, Campbellton River, Salmon Brook, Middle Brook, and Terra Nova River (Figures 9 and 10, Table 3). Record low returns occurred at Salmon Brook and Campbellton River. Historically, Northwest River near Port Blandford was assessed from 1995-2011. After a period with no counts (2012-16), this river was re-assessed in 2017 and total returns were higher than any other year within the time series.

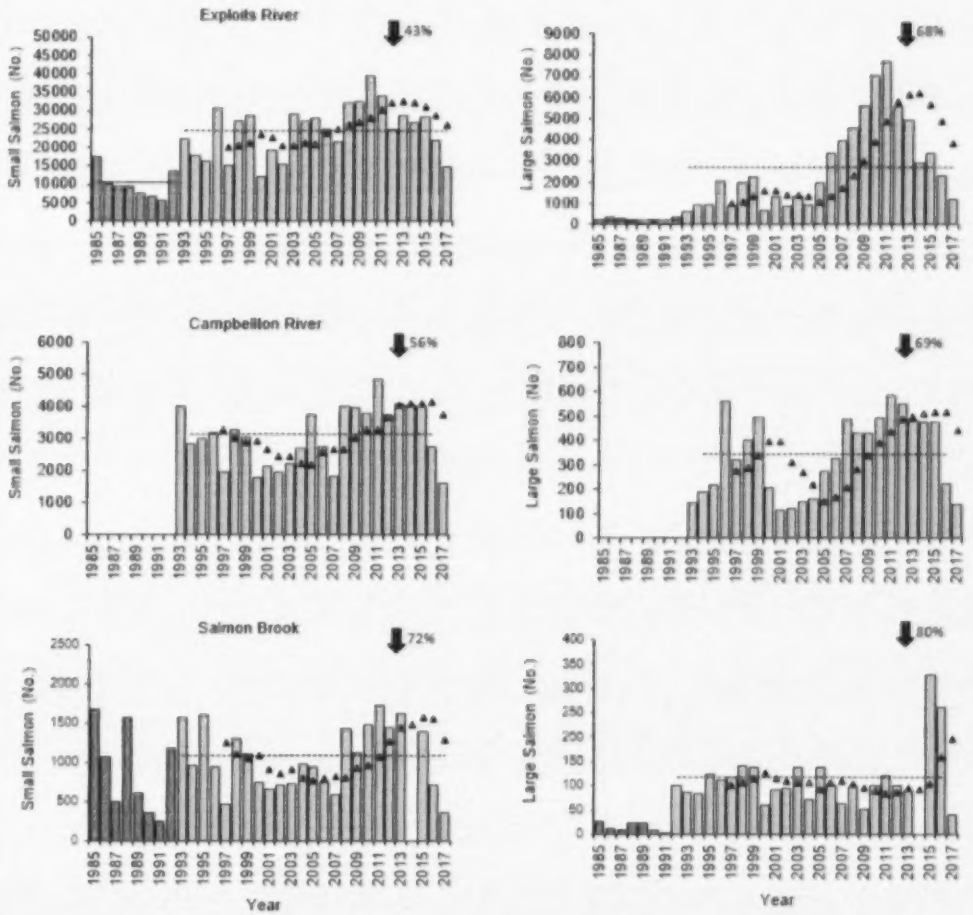

Figure 9: Total returns of small and large salmon at the three monitored rivers in SFA 4, 1985 to 2017. The solid black line is the average of the pre-moratorium time series (prior to 1992) and the dashed horizontal line is the post-moratorium average (post-1992). The black triangles are the previous generation average (five years) for each year.

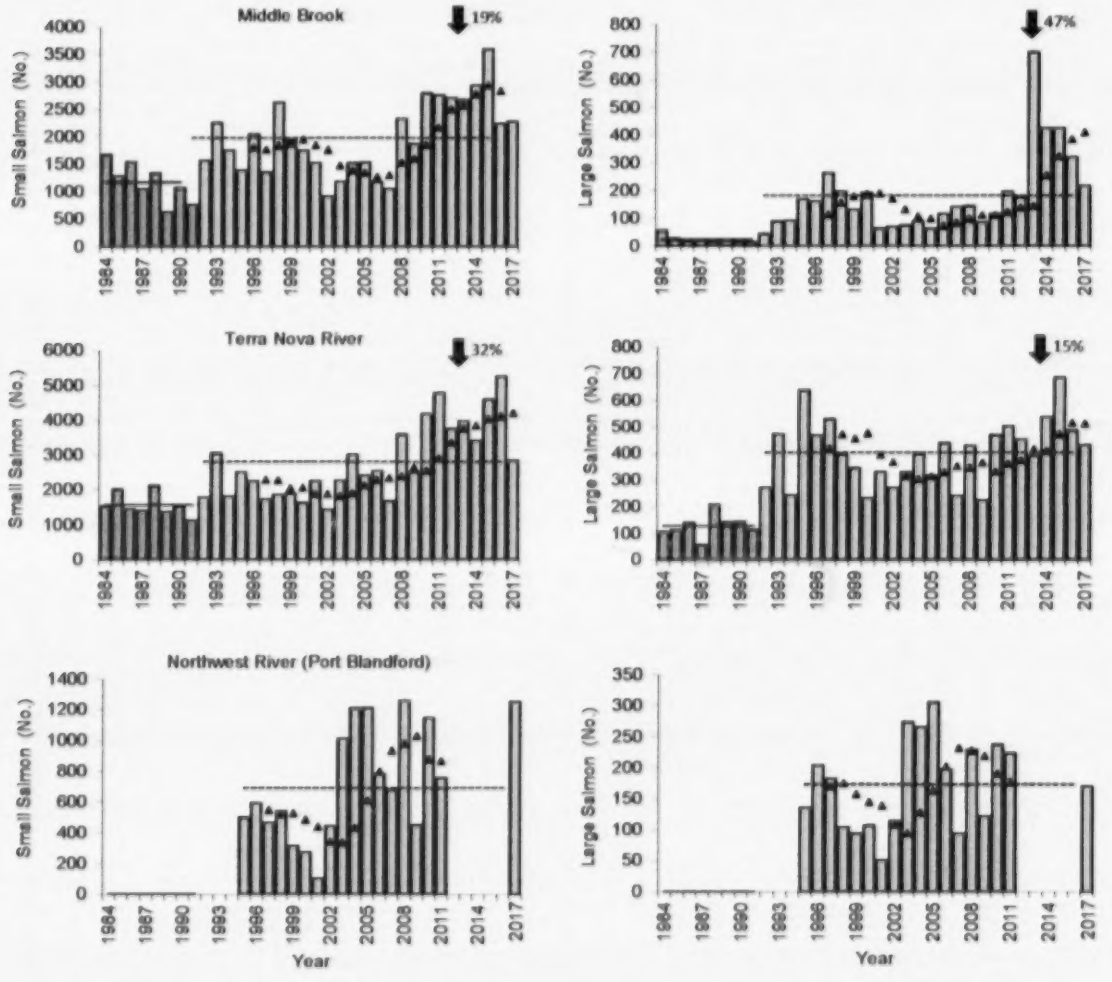

Figure 10: Total returns of small and large salmon at the three monitored rivers in SFA 5, 1984 to 2017. The solid black line is the average of the pre-moratorium time series (prior to 1992) and the dashed horizontal line is the post-moratorium average (post-1992). The black triangles are the previous generation average (five years) for each year.

In 2017, estimated egg depositions exceeded the USR on Campbellton River and Middle Brook (Table 3). These two rivers have exceeded the LRP every year since 1992. Eggs based on returns of all size groups of Atlantic Salmon to Salmon Brook (40%), Exploits River (25%), Northwest River (Port Blandford) (91%) and Terra Nova River (51%) were below the LRP in 2017. The latter three of these rivers have consistently been below the LRP over the time series of assessments. Large areas of rearing habitat were made accessible in the upper areas of Exploits River (above Red Indian Dam, 1989) and Terra Nova River (above Mollyguajeck Falls, 1985) which have not been fully colonized and therefore have consequences on the proportion of the total river egg deposition requirements achieved. Adult salmon counts are obtained at three locations on the Exploits River: Bishop's Falls, Grand Falls and Red Indian Lake dam.

Assessing the Exploits River in three separate sections resulted in 5% of the LRP attained for the lower section (below Grand Falls), 34% for the middle section (Grand Falls to Red Indian Lake), and 6% for the upper section (above Red Indian Lake dam) (Table 3).

In 2017, the estimated exploitation rate by the recreational fishery (expressed as losses of estimated eggs due to retention of small salmon and mortality (10%) associated with catch-and-release) ranged from 4% (Terra Nova River) to 17% (Exploits River) in the five monitored rivers in this area (Table 3).

South Newfoundland (SFAs 9-11)

There are fourty-eight scheduled salmon rivers in SFAs 9-11. Five rivers were assessed in 2017: Rocky River in SFA 9, Northeast River, Placentia Bay in SFA 10, Garnish River, Conne River and Little River in SFA 11.

Total returns of small and large salmon to Conne River in 2017 were below the previous five-year mean (2012-16) (Figure 11, Table 3) and were the lowest recorded in the 32-year time series. Only 32% of the LRP was achieved in 2017. Since monitoring began in 1986, returns of small salmon to Conne River have decreased by 87%, while large salmon have declined by 94%, with no indication that salmon returns will improve.

Little River showed a similar trend as Conne River in 2017 with total returns less than the previous five-year mean and only 4% of the LRP achieved (Figure 11, Table 3), the lowest value on record.

Assessments began on Garnish River in 2015. In 2017, returns of small and large salmon were 46% and 33% above the previous year, respectively, but were 11% and 5% below the 2015-16 mean, respectively (Figure 11, Table 3). Overall, salmon returns to Garnish River are well below expected based on the reported angling catches during the period 1974-1993. In 2017, estimated egg deposition remained below the LRP (40%) for the third consecutive year.

The fishway on Rocky River was not operational in 2015 as it was undergoing reconstruction. During upstream migration, fish were intercepted below the fishway and transferred further upstream. However, returns likely do not reflect the number of fish that would have returned to the river naturally had the fishway been operational, as there were challenges in capturing and transferring fish due to environmental conditions. Although fishway construction was completed in 2016 prior to the upstream salmon migration, there were still some operational issues that likely prevented all returning fish from entering the river that year. These low returns in 2015 and 2016 could influence adult returns in subsequent years. In 2017, total returns of small salmon were 27% higher than the previous five-year mean (which included the 2015 return year), while large salmon were 39% lower than the five-year mean (Figure 12). Estimated egg deposition for Rocky River in 2017 was estimated at 37% of the LRP (Table 3).

Northeast River in Placentia Bay was previously assessed from 1984 to 2002. After a period with no counts (2003-14), assessments were re-established in 2015. In 2017, total returns of small and large salmon were 56% and 67% lower, respectively, compared to the ten-year mean (1993-2002), and were lower compared to 2015 and 2016 (Figure 12, Table 3). However, estimated egg depositions in 2017 were192% of the LRP, and therefore above the USR for the third consecutive year (Table 3).

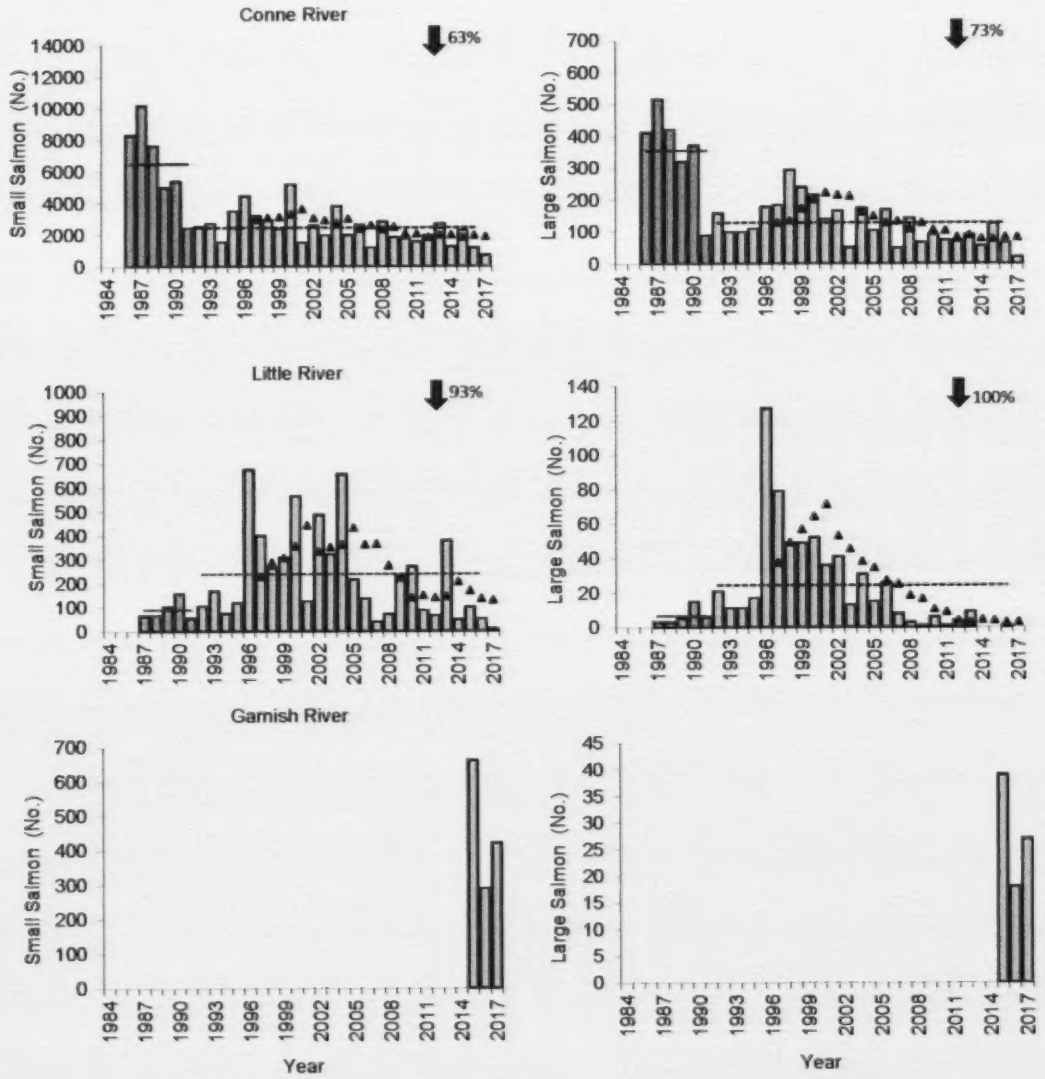

Figure 11: Total returns of small and large salmon at the three monitored rivers in SFA 11, 1984 to 2017. The solid black line is the average of the pre-moratorium time series (prior to 1992) and the dashed horizontal line is the post-moratorium average (post-1992). The black triangles are the previous generation average (five years) for each year.

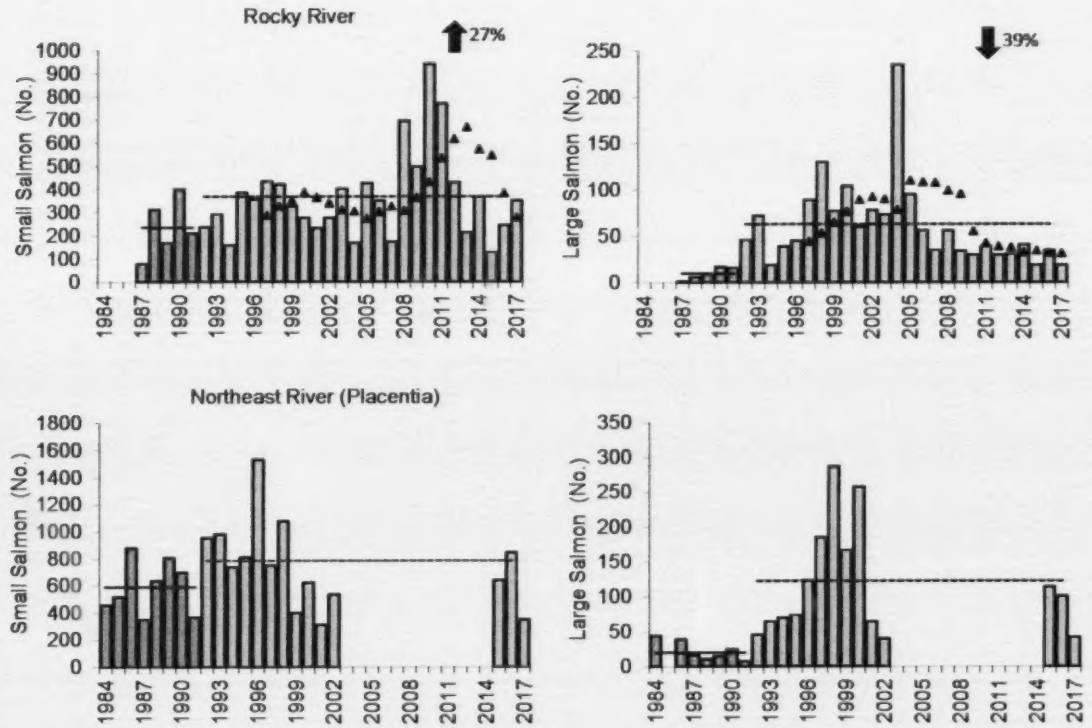

Figure 12: Total returns of small and large salmon at the two monitored rivers in SFAs 9 and 10, 1984 to 2017. The solid black line is the average of the pre-moratorium time series (prior to 1992) and the dashed horizontal line is the post-moratorium average (post-1992). The black triangles are the previous generation average (five years) for each year.

For the two monitored rivers in this area with recreational fisheries, the exploitation rates (losses of eggs) in 2017 were estimated at 14% for Northeast River, Placentia and 9% for Garnish River (Table 3).

The consequences of a single large aquaculture escape event in 2013 for wild populations of Atlantic Salmon in a southern Newfoundland fjord have been examined in recent years using targeted genomic tools. In 2014, the unambiguous, widespread detection of first- and second-generation wild-aquaculture hybrid salmon and pure aquaculture offspring was reported (i.e. 35% hybrids in 17/18 rivers within 75 km of escape site). Repeated sampling of these rivers in recent years has shown that the number of hybrids (one wild and one aquaculture parent) and feral (two aquaculture parents) salmon peaked in 2014 and has consistently declined thereafter. In addition, four separate surveys for aquaculture escapees were conducted each year in the fall of 2015, 2016 and 2017 in the Fortune Bay and Bay d'Espoir areas. In 2015, a total of 159 escapees were detected, compared to no detected escapees in 2016 and 2017 despite similar levels of effort. Monitoring of levels of hybridization and the presence and abundance of escapees will continue in southern Newfoundland in the fall of 2018. Additional field work has been carried out in Placentia Bay in 2016 and 2017 to establish a genetic baseline that may be used to evaluate potential impacts on wild Atlantic Salmon populations from a proposed future aquaculture expansion.

Southwest Newfoundland (SFAs 12-13)

There are ten scheduled salmon rivers in SFA 12. No rivers were assessed in 2017.

There are eighteen scheduled salmon rivers in SFA 13. Two rivers were assessed in 2017: Harry's River and Corner Brook Stream. Atlantic Salmon were monitored on Harry's River at a location approximately 3 km upstream from the river mouth using a DIDSON (dual-frequency identification sonar) system. Total returns of salmon in 2017 were 35% lower than the previous five-year mean (2012-16) (Figure 13, Table 3). In 2017, estimated egg deposition for Harry's River was below the LRP (73%) for the first time since 2013. Returns of small and large salmon to Corner Brook Stream in 2017 were 45% and 7% lower than the previous five-year mean (2012-16), respectively, and total returns were the lowest in the time series. Estimated egg depositions for Corner Brook Stream exceeded the USR from 2009-16, but were in the cautious zone (145%) in 2017 (Table 3).

In Harry's River, the exploitation rate (losses of eggs) in the recreational fishery in 2017 was estimated at 11% (Table 3).

Northwest Newfoundland (SFA 14A)

There are twenty-two scheduled salmon rivers in SFA 14A. Two rivers were assessed in 2017: Torrent River and Western Arm Brook. Returns of small and large salmon in 2017 were lower than the previous five-year mean (2012-16) for both Torrent River and Western Arm Brook (Figure 14, Table 3). Estimated egg depositions of Torrent River and Western Arm Brook exceeded the USR for both rivers in 2017 (541% and 324% of the LRP, respectively) and have done so annually since 1984 and 1992, respectively.

The exploitation rate (losses of eggs) in the recreational fishery for Torrent River in 2017 was estimated at 24% (Table 3). There is no recreational fishery on Western Arm Brook.

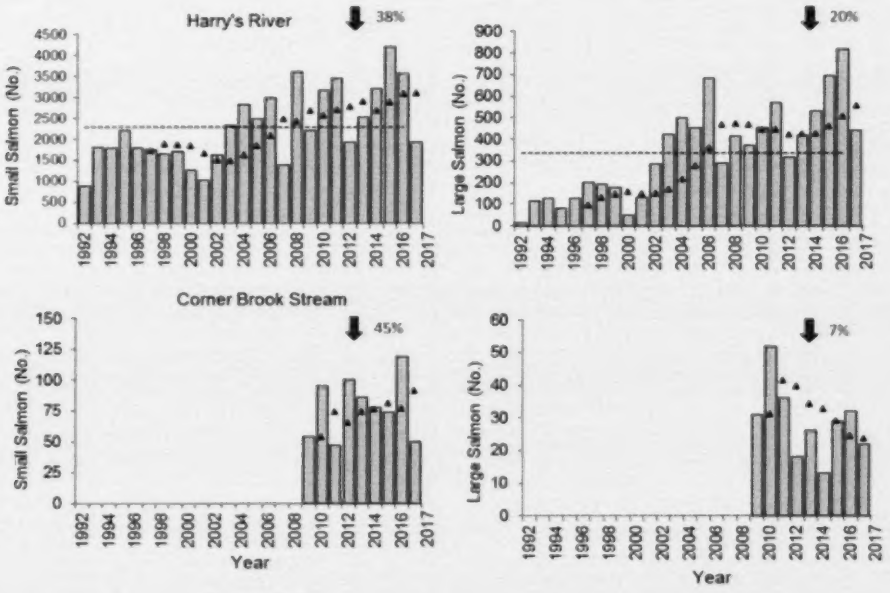

Figure 13: Total returns of small and large salmon at the two monitored rivers in SFA 13, 1992 to 2017. The dashed horizontal line is the post-moratorium average (post-1992). The black triangles are the previous generation average (five years) for each year.

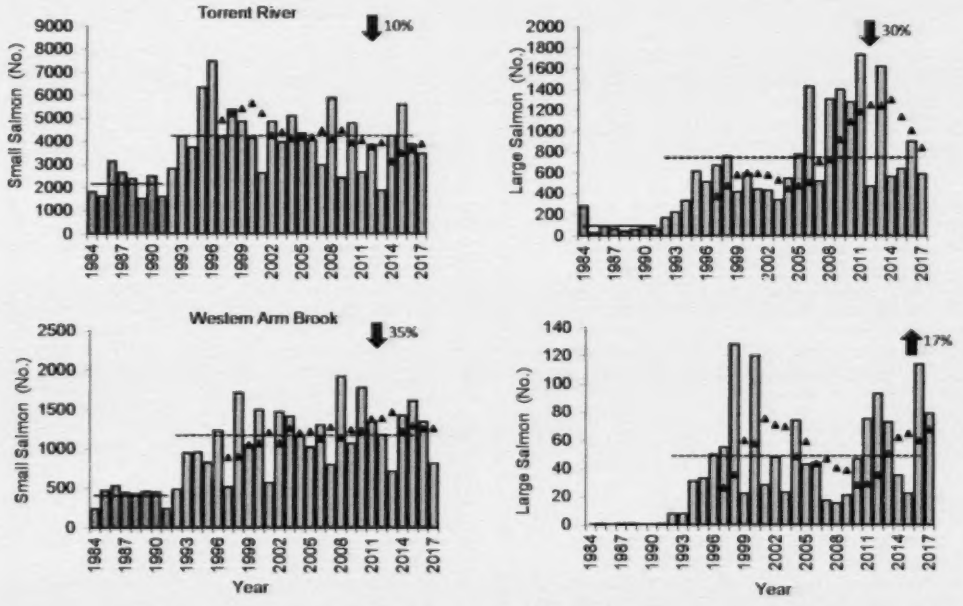

Figure 14: Total returns of small and large salmon at the two monitored rivers in SFA 14A, 1984 to 2017. The solid black line is the average of the pre-moratorium time series (prior to 1992) and the dashed horizontal line is the post-moratorium average (post-1992). The black triangles are the previous generation average (five years) for each year.

Smolt Production and Marine Survival

Atlantic Salmon smolt migrations were monitored on five rivers in 2017: Campbellton River (SFA 4), Rocky River (SFA 9), Garnish River (SFA 11), Conne River (SFA 11), and Western Arm Brook (SFA 14A). Smolts are counted directly at monitoring facilities during downstream migration with the exception of Conne River, where a mark-recapture method is used to estimate smolt production. Smolt counts obtained during downstream migration at a monitoring facility in a given year can be combined with the adult count the following year to estimate smolt to adult survival, which provides insights into marine survival trends over time.

Smolt production

In 2017, smolt production decreased on Western Arm Brook (SFA 14A), Rocky River (SFA 9) and Campbellton River (SFA 4), but increased on Conne River (SFA 11) in comparison with the river-specific previous five-year means (2012-16) (Figure 7, Table 1). A complete smolt count, 11,833 fish, was obtained for Garnish River for the first time in 2017. Smolt production on Rocky River appears to be low and is expected to continue as adult returns have also been in decline. The low returns on Rocky River in 2015 and 2016 can be partially explained by disruptions to upstream migration caused by replacement of the fishway and related operational challenges.

Since 1996, the first year of expected increase in smolt production resulting from the commercial salmon moratorium, there has been a general declining trend of smolt numbers on Conne River and no significant trend on Western Arm Brook. The number of smolts on Campbellton River declined following the moratorium but has increased since 2005.

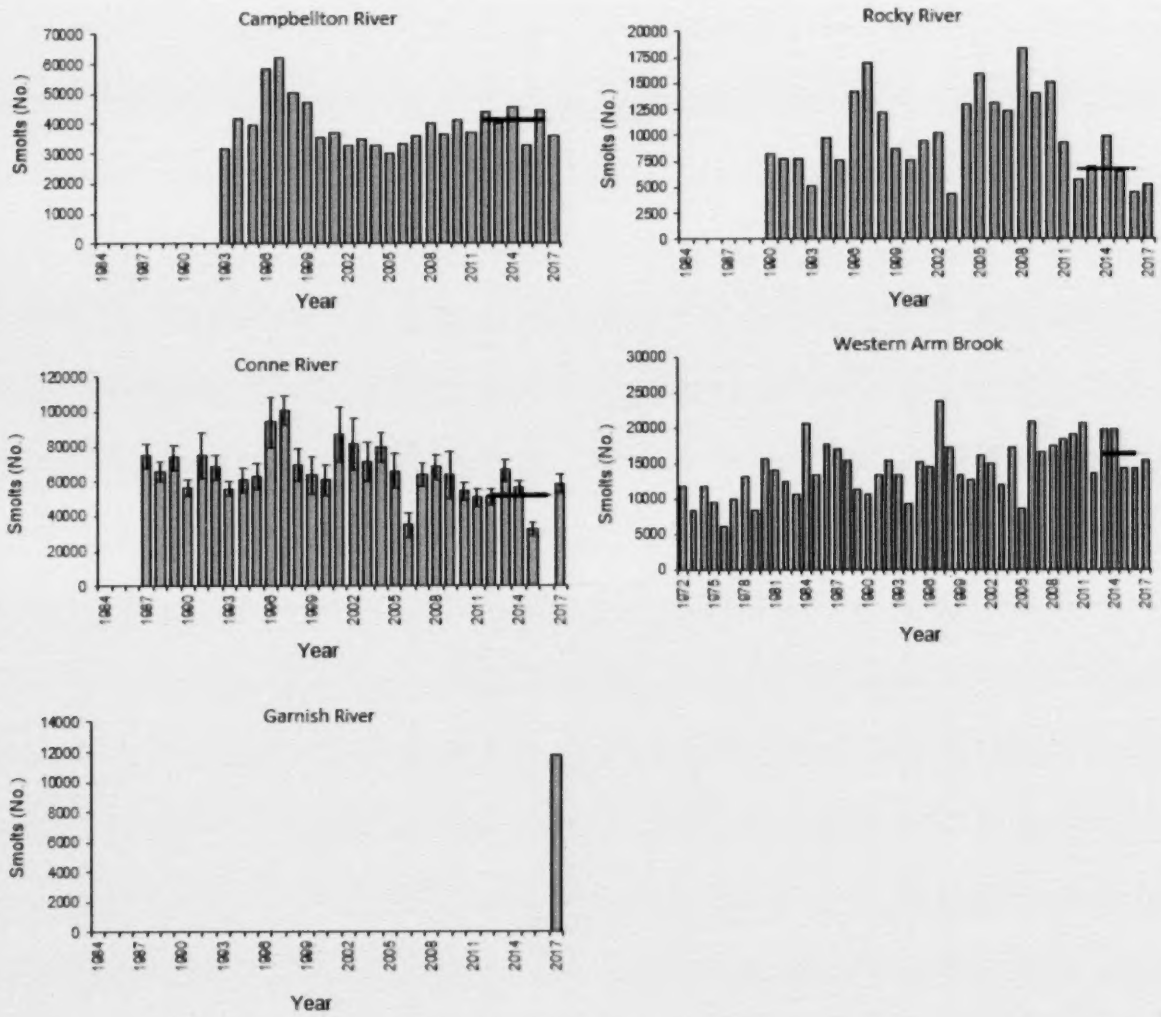

Figure 15: Smolt production on monitored Newfoundland Atlantic Salmon rivers. Horizontal solid line illustrates the previous five-year mean (2012-16). For Conne River, the error bars represent 95% confidence intervals for the annual smolt production estimates obtained from a mark-recapture program.

Marine survival

Marine survival estimates, from 2016 smolt migration and corresponding small salmon returns in 2017, averaged 5.7% (range of 3.7% to 7.7%) across the three monitored rivers (Campbellton River, Rocky River, Western Arm Brook) which had complete smolt counts in 2016 (Figure 15). Marine survival estimates were unavailable for two of the five rivers (Garnish and Conne Rivers) where smolts were counted in 2017 as counts were incomplete in 2016 due to extremely high water conditions. However, using a lower (30,000) and upper (60,000) range of smolts produced over the past decade, the return rates of small salmon for Conne River in 2017 were likely in the range of 1.1 to 2.3% and would have been the lowest recorded. In recent years, survival has been decreasing on Campbellton River and in 2017 it was the second lowest in the time series. In contrast, survival has been increasing on Western Arm Brook since 1992, although the 2017

marine survival rate was the lowest since 2013. It should be noted that the trends on either river are not outside the normal variation observed over the time series. In contrast to recent years, marine survival in 2017 was higher at southern locations (Rocky River) by comparison with northern populations (Western Arm Brook and Campbellton River). As returns of small salmon include a portion of repeat spawners, marine survival of smolt to maiden one-sea-winter salmon will be slightly less than the numbers reported here.

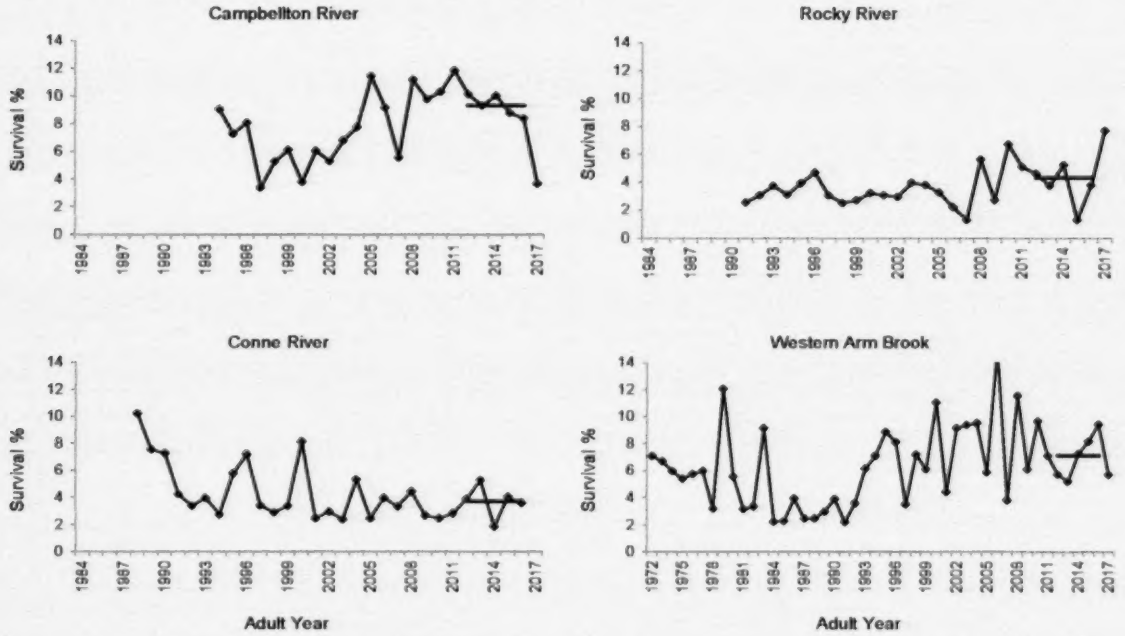

Figure 16: Marine survival rates of smolt to adult small salmon for monitored Newfoundland rivers. Survival rates have not been adjusted for marine exploitation during the commercial salmon fishery (prior to 1992) thus values represent survival of salmon back to the river. Horizontal solid line illustrates the previous five-year mean (2012-16).

Ecosystem Considerations

Sea ice extent is positively related to adult run timing (date) for Atlantic Salmon (Dempson et al. 2017). The extent of spring sea ice was above normal in 2017 with anomalous sea ice duration in inshore regions (15-60 days longer) coinciding with relatively late adult salmon runs on almost all monitored rivers in NL. In addition, total spring phytoplankton production and intensity was at a record low in 2017. The combined biomass of small and large zooplankton declined by 75% in 2017 compared to the reference period mean. This is consistent with a large reduction in zooplankton biomass observed since 2015 across the Northwest Atlantic Ocean involving a shift in community structure with declines in large energy-rich copepod *Calanus finmarchicus* and increases in small, warm water copepods. Lower potential energy transfer to higher trophic levels driven by environmental conditions could potentially influence prey conditions for salmon and may have contributed to the declines in salmon returns during 2016 and 2017.

Sources of Uncertainty

No current assessments are available on salmon populations in SFAs 3, 6, 7, 8, 12 and 14B and the Lake Melville area of SFA 1.

Salmon populations in assessed rivers may not be representative of all rivers in the SFA.

Historical or estimated biological characteristic data (e.g. fecundity, sex ratio, female size) are generally used in the assessment process. Given that these values can vary annually and are not collected on an annual basis, there is uncertainty in the estimation of egg depositions.

Estimates of recreational catch and effort data are dependent on the number and accuracy of angler licence stubs completed and returned each year. Similarly, FSC and subsistence harvest estimates in Labrador are dependent on the number and accuracy of logbooks compiled and returned. For all salmon fisheries, uncertainty exists where either inaccurate or incomplete information is provided.

CONCLUSIONS AND ADVICE

Nineteen river populations of Atlantic Salmon were assessed in 2017. Twelve of these populations recorded declines in total returns of greater than 30% by comparison with their previous five-year means and five of these rivers had record low returns. Two consecutive years (2016 and 2017) of declines of this magnitude (>30%) over a wide geographic range are highly unusual for the NL Region and has not occurred since the commercial moratorium of 1992.

In 2017, spawning escapements (eggs) were below the river-specific LRP on three of the four assessed rivers in Labrador, while spawning escapement of the fourth river exceeded its USR point. In Newfoundland, spawning escapements (eggs) were below the LRP for nine of the fifteen (60%) assessed rivers. Of the remaining Newfoundland rivers assessed in 2017, five out of fifteen (33%) rivers exceeded the USR point, and one assessed river fell within the cautious zone (between the LRP and USR). In 2017, the status of rivers relative to the reference points on the basis of returns (prior to in-river fisheries exploitation) is similar to that based on spawners.

In the monitored rivers in 2017 for which recreational fisheries were allowed, losses of eggs (from retention and catch-and-release mortality) were 5% for Sand Hill River (Labrador - SFA 2) and ranged from 4% to 24% in Newfoundland. The highest exploitation rate (24%) was in Torrent River which had egg depositions above the USR after the fishery. Exploitation rates of 13% (Salmon Brook) and 17% (Exploits River) were estimated in two rivers of SFA 4 for which the total returns in 2017 were less than 50% of the LRP (Table 3). The Exploits River Atlantic Salmon population has been rebuilding over the past decades following the provision of access to previously inaccessible habitat above Red Indian Lake dam in the upper reaches of the river.

The South Newfoundland (SFAs 9-12) Atlantic Salmon populations remain a concern, Conne River in particular. Total returns of small and large salmon to Conne River in 2017 were just above 700 fish (32% of the LRP) and the lowest recorded in the 32-year time series. Since monitoring began in 1986, returns of small salmon to Conne River have decreased by 87%, while large salmon have declined by 94%, with no indication that salmon returns will improve. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2010) designated South Newfoundland (Designatable Unit, DU 4) salmon populations as threatened. There is genetic evidence that farmed salmon escapees are breeding with wild Atlantic Salmon in southern Newfoundland rivers. The consequences of continued farmed salmon escapes and subsequent interbreeding with wild Atlantic Salmon could be a loss of genetic diversity although the long-term consequences of this on wild salmon populations are uncertain.

Broad-scale ocean climate conditions associated with primary and secondary production in the Northwest Atlantic region show a general decline in productivity indices. The large reduction in zooplankton biomass observed since 2015 suggests lower potential energy transfer to higher trophic levels, including Atlantic Salmon which may subsequently affect marine survival. In general, low marine survival continues to be an area of concern and is likely the limiting factor affecting abundance of NL salmon.

There were large unexpected declines in 2016 and 2017 in Atlantic Salmon returns. Sea ice departure in the inshore regions along the east and northeast coasts of Newfoundland in 2017 was delayed by up to 45 days in some areas resulting in a significant delay (up to 50 days) in the spring warming (to 3°C) of inshore coastal waters. The consequences of these environmental conditions on realized returns of salmon in 2017, survival rates of smolts migrating in 2017, and subsequently adults returning in 2018 are unknown. Expected adult returns in 2018 cannot be accurately predicted. Based on the experience of 2017, an in-season evaluation of returns to date with projections for the end-of-year abundance accurately predicted the returns for 2017. A similar approach could be considered for 2018.

OTHER CONSIDERATIONS

Indicators and procedure to trigger full assessment during interim years

In 2014, DFO began implementing a five-year management plan for Atlantic Salmon in the NL Region. Although management measures outlined in the plan were expected to remain the same over this five-year period, changes would be warranted if there was a dramatic change in salmon stocks, particularly declines. To this end, DFO Science was asked by Resource Management to identify 'triggers/indicators' that would warrant revisiting the salmon management plan earlier than the planned five years. Thus, these triggers mainly reflect significant conservation concerns related to the health and abundance of salmon stocks within the NL Region.

There were two scenarios where DFO Science would recommend revisiting the five-management plan earlier:

1. >30% **decline** in total returns on ≥50% of monitored rivers in any given year; or
2. >25% **decline** in total returns on ≥50% of monitored rivers in two consecutive years.

All comparisons will be made using both the previous five-year mean (short-term trends) as well as the previous ten-year mean (long-term trends).

In 2016, declines of Atlantic Salmon returns were significant enough to trigger re-visiting the five-year salmon management plan. Following this recommendation, a decision was made by DFO to move to a two-year salmon management plan in the NL Region, which included a full salmon assessment for 2017 returns.

Given the two consecutive years of low returns in 2016 and 2017, comparing 2018 returns to its previous five-year mean would require including 2016 and 2017 which may not give a true indication of the 2018 stock status. Therefore, it was agreed that going forward, comparisons of annual returns will be made relative to the generation mean prior to the significant declines observed in 2016 and 2017 (e.g. 2011-15 rather than 2013-17).

SOURCES OF INFORMATION

This Science Advisory Report is from the February 28 to March 1, 2018 Regional Peer Review Process on the Assessment of Atlantic Salmon in NL. Additional publications from this meeting

will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

Bradbury, I.R., Hamilton, L.C., Rafferty, S., Meerburg, D., Poole, R., Dempson, J.B., Robertson, M.J., Reddin, D.G., Bourret, V., Dionne, M., Chaput, G., Sheehan, T.F., King, T.L., Candy, J.R., and Bernatchez, L. 2015. Genetic evidence of local exploitation of Atlantic Salmon in a coastal subsistence fishery in the Northwest Atlantic. Can. J. Fish. Aquat. Sci. 72(1): 83-95.

Bradbury, I.R., Hamilton, L.C., Chaput, G., Robertson, M.J., Goraguer, H., Walsh, A., Morris, V., Reddin, D., Dempson, J.B., Sheehan, T.F., King, T., and Bernatchez, L. 2016a. Genetic mixed stock analysis of an interceptory Atlantic Salmon fishery in the Northwest Atlantic. Fisheries Research. 174: 234-244.

Bradbury, I.R., Hamilton, L.C., Sheehan, T.F., Chaput, G., Robertson, M.J., Dempson, J.B., Reddin, D., Morris, V., King, T., and Bernatchez, L. 2016b. Genetic mixed-stock analysis disentangles spatial and temporal variation in composition of the West Greenland Atlantic Salmon fishery. ICES J. Mar. Sci. 73(9): 2,311-2,321.

Committee on the Status of Endangered Wildlife in Canada. 2010. COSEWIC assessment and status report on the Atlantic Salmon *Salmo salar* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 136 p.

Dempson, J.B., O'Connell, M.F., and Cochrane, N. 2001. Potential impact of climate warming on recreational fishing opportunities for Atlantic Salmon, *Salmo salar* L., in Newfoundland, Canada. Fish. Manage. Ecol. 8: 69-82.

Dempson, J.B., O'Connell, M.F., and Schwarz, C.J. 2004. Spatial and temporal trends in abundance of Atlantic Salmon, *Salmo salar*, in Newfoundland with emphasis on impacts of the 1992 closure of the commercial fishery. Fish. Manage. Ecol. 11: 387-402.

Dempson, J.B., Scwarz, C.J., Bradbury, I.R., Robertson, M.J., Veinott, G., Poole, R., and Colbourne, E. 2017. Influence of climate and abundance on migration timing of adult Atlantic Salmon (*Salmo salar*) among rivers in Newfoundland and Labrador. Ecol. Freshw. Fish. 26: 247-259.

DFO. 2007. 2007-2011 Atlantic Salmon integrated management plan Newfoundland and Labrador. Fisheries Management Branch, Newfoundland Region. St. John's, NL.

DFO. 2009. A Fishery Decision-Making Framework Incorporating the Precautionary Approach. Accessed February, 2018.

DFO. 2012. Recovery Potential Assessment for the South Newfoundland Atlantic Salmon (*Salmo salar*) Designatable Unit. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2012/007. 43 p.

DFO. 2015. Development of reference points for Atlantic Salmon (*Salmo salar*) that conform to the Precautionary Approach. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2015/058.

DFO. 2017. Stock Assessment of Newfoundland and Labrador Atlantic Salmon – 2016. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2017/035.

ICES. 2015. Report of the Working Group on North Atlantic Salmon (WGNAS), 17–26 March, Moncton, Canada. ICES CM 2015/ACOM:09. 332 pp.

NASCO. 2009 NASCO Guidelines for the Management of Salmon Fisheries. NASCO. Edinburgh, Scotland, UK, NASCO Council Document CNL (09) 43. 12 p.

O'Connell, M.F., and Dempson, J.B. 1995. Target spawning requirements for Atlantic Salmon, *Salmo salar* L., in Newfoundland rivers. Fish. Manage. Ecol. 2: 161-170.

O'Connell, M.F. 2003. Uncertainty about estimating total returns of Atlantic Salmon, *Salmo salar,* to the Gander River, Newfoundland, Canada, evaluated using a fish counting fence. Fish. Manage. Ecol. 10: 23–29.

Reddin, D.G., Dempson, J.B., and Amiro, P.G. 2006. Conservation requirements for Atlantic Salmon (*Salmo salar* L.) in Labrador rivers. DFO Can. Sci. Advis. Sec. Res. Doc. 2006/071. 29 pp.

Veinott, G., and Cochrane, N. 2015. Characteristics of the Newfoundland and Labrador Atlantic Salmon (*Salmo salar)* Recreational Fishery based on Angler Logs and Phone Surveys (1994-2013). Can. Manuscr. Rep. Fish. Aquat. Sci. 3082: vii + 51 p.

Veinott, G., and Caines, D. 2016. Estimating proportion of large salmon on Harry's River, Newfoundland using a DIDSON acoustic camera. Can. Manuscr. Rep. Fish. Aquat. Sci. 3100: iii + 11 p.

APPENDIX: DETAILS ON CATCHES AND HARVESTS AND STATUS OF ATLANTIC SALMON IN NEWFOUNDLAND AND LABADOR

Table 1: Recreational fishery catch (retained plus released), harvest (retained), and effort estimates for Newfoundland and Labrador (SFAs 1-14B), 1994-2017. Estimates for 2017 are preliminary.

Year	Effort (rod days)	Small Salmon Retained	Small Salmon Released	Large Salmon Retained	Large Salmon Released	Total Retained	Total Released
1994	141,384	31,774	24,442	455	5,032	32,229	29,474
1995	136,028	33,005	26,273	408	5,166	33,413	31,439
1996	162,952	38,005	34,342	334	6,209	38,339	40,551
1997	131,559	25,184	25,316	158	4,720	25,342	30,036
1998	131,329	24,799	31,368	231	4,375	25,030	35,743
1999	131,432	24,946	24,567	320	4,153	25,266	28,720
2000	138,284	24,369	29,705	262	6,479	24,631	36,184
2001	110,754	23,026	22,348	338	5,184	23,364	27,532
2002	103,894	22,984	23,071	207	3,992	23,191	27,063
2003	102,915	23,338	21,379	222	4,965	23,560	26,344
2004	99,453	21,754	23,430	259	5,168	22,013	28,598
2005	125,613	23,876	33,129	291	6,598	24,167	39,727
2006	113,643	21,050	30,491	227	5,694	21,277	36,185
2007	95,585	16,339	17,719	235	4,607	16,574	22,326
2008	152,699	29,433	32,787	200	7,034	29,633	39,821
2009	144,931	24,458	26,681	216	4,272	24,674	30,953
2010	128,265	30,495	39,046	197	6,383	30,692	45,429
2011	116,951	28,744	26,240	*	8,119	28,744	34,359
2012	113,653	23,269	20,940	*	4,089	23,269	25,029
2013	134,348	24,393	19,962	*	6,770	24,393	26,732
2014	118,222	24,120	19,613	*	5,388	24,120	25,001
2015	141,380	31,173	25,382	*	7,079	31,173	32,461
2016	146,438	30,056	26,145	*	10,206	30,056	36,351
2017	121,047	19,396	16,830	*	6,007	19,396	22,837
Previous 5-year mean (2012-16)	130,808	26,602	22,408	0	6,706	26,602	29,115
2017 % Change from previous 5-year mean	12	-27	-25	0	-10	-27	-22

* Retention of large salmon has not been permitted since 2011.

Table 2: Estimated harvests of Atlantic Salmon in Aboriginal and Subsistence Fisheries in Labrador (SFAs 1 and 2), 1999-2017. Estimates for 2017 are preliminary.

Year	Small salmon: Number	Small salmon: Weight (kg)	Large salmon: Number	Large salmon: Weight (kg)	Total Number	Total Weight (kg)
1999	2,739	5,580	1,084	4,220	3,824	9,800
2000	5,323	10,353	1,352	5,262	6,675	15,613
2001	4,789	9,789	1,673	6,499	6,478	16,288
2002	5,806	11,581	1,437	5,990	7,243	17,572
2003	6,477	13,196	2,175	8,912	8,653	22,108
2004	8,385	17,379	3,696	14,167	12,081	31,546
2005	10,436	21,038	2,817	10,876	13,253	31,914
2006	10,377	21,198	3,090	11,523	13,467	32,721
2007	9,208	17,070	2,652	9,386	11,860	26,456
2008	9,838	19,396	3,905	16,944	13,743	36,340
2009	7,988	16,130	3,344	13,681	11,332	29,810
2010	10,156	20,945	3,840	15,511	13,996	36,456
2011	11,301	23,442	4,533	18,535	15,834	41,978
2012	9,977	18,738	4,228	17,821	14,204	36,560
2013	7,164	14,674	6,374	25,299	13,539	39,973
2014	8,953	17,550	3,991	14,847	12,944	32,397
2015	8,923	17,500	6,146	24,935	15,069	42,435
2016	7,645	14,579	5,595	25,022	13,240	39,601
2017	7,163	15,645	6,409	30,907	13,572	46,552
Previous six-year mean (2011-16)	8,994	17,747	5,144	21,077	14,138	38,824
2017 % Change from previous six-year mean	-20	-12	+25	+47	-4	+20

Table 3: Summary of Atlantic Salmon stock status in Newfoundland and Labrador (SFAs 1-14B). The Limit Reference Point (LRP) and Upper Stock Reference point (USR) correspond to 100% and 150% of the previously achieved conservation egg requirement, respectively. Generation average corresponds to previous five years in Newfoundland (2012-16) and six years in Labrador (2011-16).

River	Total Returns in 2017	Total Returns in 2017 as a Proportion of Previous Generation Average	Proportion of LRP Attained Based on Spawners (after in-river fisheries)	Proportion of LRP Attained Based on Returns (before in-river fisheries)	Percent Decline in Proportion of LRP Attained From In-River Fisheries	Proportion of USR Attained Based on Spawners (after in-river fisheries)	Proportion of USR Attained Based on Returns (before in-river fisheries)	Number of years in which the LRP was met or exceeded by spawners (2017 and previous generation)
English River (SFA 1)	744	97%	248%	248%	-	165%	165%	7 of 7
Southwest Brook (SFA 2)	69	27%	22%	83%	-	55%	55%	2 of 7
Muddy Bay Brook (SFA 2)	193	56%	83%	22%	-	15%	15%	2 of 6
Sand Hill River (SFA 2)	2,236	46%	52%	55%	5%	35%	37%	1 of 7
*Exploits River (SFA 4)	16,017	53%	25%	30%	17%	17%	20%	0 of 6
Campbellton River (SFA 4)	1,783	43%	163%	175%	7%	109%	117%	6 of 6
Salmon Bk. Gander River (SFA 4)	394	27%	40%	46%	13%	27%	31%	4 of 5[†]
Middle Brook (SFA 5)	2,494	77%	264%	285%	7%	176%	190%	6 of 6
*Terra Nova River (SFA 5)	3,277	70%	51%	53%	4%	34%	35%	0 of 6
Northwest River (TNNP) (SFA 5)	1,418	-	91%	-	-	61%	-	-
*Rocky River (SFA 9)	371	-	37%	37%	-	25%	25%	0 of 6
Northeast River (Placentia) (SFA 10)	393	-	192%	224%	14%	128%	149%	-
*Little River (SFA 11)	9	7%	4%	4%	-	3%	3%	1 of 6
*Conne River (SFA 11)	710	36%	32%	32%	-	21%	21%	2 of 6

River	Total Returns in 2017	Total Returns in 2017 as a Proportion of Previous Generation Average	Proportion of LRP Attained Based on Spawners (after in-river fisheries)	Proportion of LRP Attained Based on Returns (before in-river fisheries)	Percent Decline in Proportion of LRP Attained From In-River Fisheries	Proportion of USR Attained Based on Spawners (after in-river fisheries)	Proportion of USR Attained Based on Returns (before in-river fisheries)	Number of years in which the LRP was met or exceeded by spawners (2017 and previous generation)
Garnish River (SFA 11)	448	-	40%	44%	9%	27%	29%	0 of 3
Harry's River (SFA 13)	2,375	65%	73%	82%	-	49%	55%	3 of 6
Corner Brook Stream (SFA 13)	72	62%	145%	145%	-	97%	97%	6 of 6
Torrent River (SFA 14A)	4,066	86%	538%	710%	-	359%	473%	6 of 6
Western Arm Brook (SFA 14A)	889	67%	324%	324%	-	216%	216%	6 of 6

* Note: these rivers have undergone various enhancement activities in the past.

† Note: there was no count in 2014.

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